United Nations A/65/210

General Assembly

Distr.: General
2 August 2010

Original: English

Sixty-fifth session
Item 12 of the provisional agenda*
2001-2010: Decade to Roll Back Malaria in Developing Countries, Particularly in Africa

2001-2010: Decade to Roll Back Malaria in Developing Countries, Particularly in Africa

Note by the Secretary-General

The Secretary-General has the honour to transmit to the General Assembly the report prepared by the World Health Organization pursuant to Assembly resolution 64/79.

* A/65/150.

10-47111 (E) 270810

Please recycle

Report of the World Health Organization entitled "2001-2010: Decade to Roll Back Malaria in Developing Countries, Particularly in Africa"

Summary

The present report highlights the progress made in meeting the goals concerning malaria control to be achieved by 2010 in the context of General Assembly resolution 62/180. It draws on the following recent progress reports: *World Malaria Report 2009* (2009), produced by the World Health Organization (WHO); *Malaria Funding and Resource Utilization: The First Decade of Roll Back Malaria* (United Nations Children's Fund (UNICEF), WHO and Programme for Appropriate Technology in Health (PATH), 2010); *World Malaria Day 2010: Africa Update* (UNICEF and PATH, 2010); and *Saving Lives with Malaria Control: Counting Down to the Millennium Development Goals* (Tulane University, Johns Hopkins University, PATH and WHO, 2010), produced by the Roll Back Malaria Partnership. Data from malaria-endemic countries and other Roll Back Malaria partners, including the Alliance for Malaria Prevention, are also used. The report concludes with recommendations for the consideration of the Assembly.

Over the past decade, malaria control efforts have attracted considerable political attention and financial support at the international, regional and country levels. At the African Summit to Roll Back Malaria, held in Abuja in 2000, African heads of State pledged to "halve the malaria mortality for Africa's people by 2010, through implementing strategies and actions for Roll Back Malaria". World leaders put forth the challenge "have halted by 2015 and begun to reverse the incidence of malaria and other major diseases" as a target of one of the eight Millennium Development Goals. In early 2008, Secretary-General Ban Ki-moon appointed a Special Envoy for Malaria to mobilize global support for action on the disease. Following the Secretary-General's call for universal coverage, and in response to a growing international push for a long-term commitment to malaria control, the malaria community collectively developed the Global Malaria Action Plan. The objectives of the plan are to accelerate and sustain malaria control efforts, eliminating the disease where possible, and to ensure investment in research aimed at new tools that would permit the eradication of the disease in the long term. Reinforced by the Special Envoy for Malaria and the recently established African Leaders Malaria Alliance, malaria control continues to be a high priority on the global development agenda in 2010.

In response to global advocacy efforts, international funding commitments for malaria control increased from less than $0.2 billion in 2000 to $1.6 billion in 2009, owing largely to the establishment of the Global Fund to Fight AIDS, Tuberculosis and Malaria and greater commitments by the President's Malaria Initiative of the United States of America, the World Bank and other agencies. This increase in funding has resulted in a dramatic scale-up of malaria control interventions in many settings and has led to measurable reductions in the malaria burden.

An increased percentage of African households (31 per cent) were estimated to own at least one insecticide-treated net in 2008 as compared with the number in 2006 (17 per cent), and more children under 5 years of age used such a net in 2008 (24 per

cent) than in previous years. Household ownership of insecticide-treated nets has reached more than 50 per cent in 13 high-burden African countries. The percentage of children using a net is below the World Health Assembly target of 80 per cent, primarily because of low net ownership in several large African countries. Resources for further scale-up are now being made available, with more than 88 million nets delivered in 2009 and a further 70 million in the first half of 2010.

The use of artemisinin combination therapies has increased compared with 2006 but remains very low in most African countries; in 11 of the 13 countries surveyed during the period 2007-2008, fewer than 15 per cent of children under 5 years of age with a history of fever had received an artemisinin combination therapy, well below the World Health Assembly target of 80 per cent. That figure provides an artificially low estimate of appropriate treatment, as the majority of children with fever did not receive a diagnostic test to confirm malaria. As of 2008, approximately 22 per cent of suspected malaria cases in Africa were confirmed through a diagnostic test.

In high-burden African countries that have achieved high coverage of their populations with bed nets and treatment programmes, recorded cases of and deaths due to malaria have fallen by 50 per cent. This suggests that the targets for Millennium Development Goal 6, aimed at reversing the incidence of malaria, can be met if there is adequate coverage with key interventions. While these results were seen in some island settings (Sao Tome and Principe and Zanzibar in the United Republic of Tanzania), they were also seen in countries on the African mainland (including Eritrea, Rwanda and Zambia). Evidence from Sao Tome and Principe, Zambia and Zanzibar suggests that large decreases in malaria cases and deaths have been mirrored by steep declines in all-cause deaths among children less than 5 years of age, indicating that intensive malaria control efforts will help many African countries to reach a two-thirds reduction in child mortality by 2015, in accordance with Millennium Development Goal 4.

A recent analysis of malaria control scale-up in 35 African countries revealed that more than 560,000 lives had been saved between 2000 and 2009, with nearly three quarters of that number saved since 2006. Overall, more than one third of the 108 malarious countries documented reductions of more than 50 per cent in confirmed malaria cases in 2008 as compared with 2000 (9 African countries and 29 outside Africa), although the number of cases fell least in the countries with the highest incidence rates. Ten countries are implementing nationwide elimination programmes, and eight countries are in the pre-elimination phase. Another eight countries have interrupted transmission and are at the stage of preventing the reintroduction of malaria. In May 2010, Morocco was certified by WHO as free of malaria, which reduced to 107 the number of malaria-endemic countries.

Parasite resistance to antimalarial medicines and mosquito resistance to insecticides pose major threats to the achievement of global malaria control. The first evidence of artemisinin resistance was reported in western Cambodia in 2008. A rapid containment response that involves detecting and treating all cases in target areas and increasing bed-net coverage of the population at risk has been implemented since January 2009. Early results suggest that the artemisinin-resistant strain of *Plasmodium falciparum* malaria has almost disappeared. However, the marketing of artemisinin monotherapies continues in many countries, despite the appeal made by WHO for a halt to their use, and remains a major threat to the useful therapeutic life of artemisinin combination therapies.

Disbursements to malaria-endemic countries, which totalled nearly $1.5 billion in 2009, still fall short of the $5 billion required annually to ensure high coverage and maximal impact worldwide. The achievement of Millennium Development Goals will require not only adequate financial resources, but also the strengthening of health systems capable of delivering vector control interventions, providing diagnostics for the parasitologic confirmation of malaria alongside treatment with artemisinin combination therapies, and developing of routine surveillance systems for malaria, for parasite resistance to antimalarial medicines and for mosquito resistance to insecticides.

I. Background and context

1. In 2008, there were an estimated 243 million cases of malaria (5th to 95th centiles, 190 million to 311 million) worldwide. The vast majority of cases (85 per cent) were in the WHO African Region, followed by the South-East Asia Region (8 per cent) and the Eastern Mediterranean Region (4 per cent). There were an estimated 863,000 deaths (5th to 95th centiles, 708,000 to 1.003 million) in 2008, of which 91 per cent were in the African Region, followed by the Eastern Mediterranean Region (6 per cent) and the South East Asia Region (3 per cent).

2. Malaria is a major killer of African children, so control of malaria will make a direct contribution to meeting the Millennium Development Goal 4 target of reducing under-5 mortality by two thirds by 2015. Malaria control will also contribute to meeting the Millennium Development Goal 5 target of reducing maternal mortality.

3. In 2007, the United Nations (through the Millennium Development Goals), the World Health Assembly and the Roll Back Malaria Partnership had consistent goals concerning intervention coverage and impact for 2010 and 2015. Coverage is intended to reach more than 80 per cent by 2010, with four key interventions: insecticide-treated nets for people at risk, appropriate antimalarial medicines for patients with probable or confirmed malaria, indoor residual spraying for targeted households at risk, and intermittent preventive treatment for pregnant women (in moderate- to high-transmission settings). The global impact targets are reductions in the number of malaria cases and deaths per capita by 50 per cent or more between 2000 and 2010 and by 75 per cent or more between 2000 and 2015.

4. On World Malaria Day in 2008, the Secretary-General called for efforts to bring an end to malaria deaths by ensuring universal coverage of malaria control interventions by the end of 2010. Consequently, the global malaria community established three additional targets as part of the Global Malaria Action Plan, launched by the Roll Back Malaria Partnership in September 2008. The first is to reduce the global number of malaria deaths to near-zero preventable deaths by 2015. This target is more ambitious than the previous target of a 75 per cent reduction in the number of malaria deaths by 2015. The second is to eliminate malaria in 8 to 10 countries by 2015 and afterwards in all countries that are in the pre-elimination phase today (2008). The third target is: "In the long term, eradicate malaria worldwide by reducing the global incidence to zero through progressive elimination in countries."

II. Policies and strategies for malaria control

5. The two most powerful and most broadly applied interventions aimed at malaria prevention through mosquito control are long-lasting insecticide-treated nets and indoor residual spraying. Because high coverage rates are needed in order to realize the full potential of either nets or spraying, WHO recommends "universal coverage" of people at risk for malaria in areas targeted for malaria prevention. In the case of long-lasting insecticide-treated nets, this means that all people at risk, regardless of age or gender, in areas targeted for malaria prevention should be provided with nets.

6. WHO recommends that long-lasting insecticide-treated nets be either delivered free of charge or made available at highly subsidized prices. Cost should not be a

barrier to their availability to all people at risk for malaria, especially those at highest risk for adverse outcomes as a result of the disease, such as young children and pregnant women.

7. Universal coverage with long-lasting insecticide-treated nets can be achieved and maintained by combining distribution through initial rapid coverage with periodic mass campaigns complemented by routine delivery to pregnant women and infants at antenatal and children's clinics by immunization contacts.

8. Only nets recommended by the WHO Pesticide Evaluation Scheme should be procured by national malaria control programmes and partners for malaria control. Such nets are designed to maintain their biological efficacy against vector mosquitoes for at least three years in the field under recommended conditions of use, obviating the need for regular insecticide treatment.

9. Twelve insecticides belonging to four chemical classes are currently recommended by the Scheme for indoor residual spraying. Dichlorodiphenyltrichloroethane (DDT) has comparatively long residual efficacy (more than six months) against malaria vectors and plays an important role in the management of vector resistance. Countries can use DDT for indoor residual spraying for as long as necessary and in the quantities needed, provided that the guidelines and recommendations of WHO and the Stockholm Convention on Persistent Organic Pollutants are complied with and until locally appropriate, cost-effective alternatives are available for a sustainable transition away from the use of DDT.

10. Resistance to insecticides, especially pyrethroids, poses an urgent and growing threat to the sustainability of current methods of vector control. Monitoring and managing resistance to the insecticides used in both long-lasting insecticide-treated nets and indoor residual spraying are vital.

11. The early and effective treatment of malaria reduces morbidity, prevents death and reduces the reservoir of infection, leading to successful malaria control. Updated WHO guidelines for the treatment of malaria were released in 2010.

12. For all patients with suspected malaria, prompt parasitologic confirmation (within two hours of a patient's presenting) through microscopy or a rapid diagnostic test is recommended before treatment is begun. Treatment based solely on clinical suspicion should be considered only when a parasitologic diagnosis is not possible. The parasitologic confirmation of malaria before treatment is becoming increasingly important, because as transmission falls, so does the proportion of fevers attributable to malaria. When all cases of fever are treated as malaria, not only are artemisinin combination therapies overused, but appropriate care is not provided to people with fever caused by other diseases. Expanded use of rapid diagnostic tests will help to reduce the overdiagnosis of malaria and the overuse of antimalarial medicines.

13. Confirmed cases of *Plasmodium falciparum* malaria without complications should be treated with an artemisinin combination therapy, and *Plasmodium vivax* malaria should be treated with chloroquine where it is effective, or with an appropriate artemisinin combination therapy in areas where *Plasmodium vivax* is resistant to chloroquine. Treatment of *Plasmodium vivax* should be combined with 14 days of primaquine to prevent relapse, after confirming that the patient does not have glucose-6-phosphate dehydrogenase deficiency.

14. Artemisinin combination therapies not only are efficacious, but also help to prevent the emergence and spread of drug-resistant *Plasmodium*. Five such therapies are currently recommended for use because of their safety and efficacy: artemether–lumefantrine, artesunate–amodiaquine, artesunate–mefloquine, artesunate–sulfadoxine-pyrimethamine and dihydroartemisinin–piperaquine. The choice of therapy should be based on the efficacy of the combination in the country or area of intended use.

15. Intermittent preventive treatment with sulfadoxine-pyrimethamine, administered two to three times during the second and third trimesters of pregnancy during antenatal care visits, is recommended for pregnant women in areas of high transmission. Intermittent preventive treatment in infants, using a single dose of sulfadoxine-pyrimethamine administered three times during the first year of life at routine Expanded Programme on Immunization visits, is recommended for areas of high transmission where sulfadoxine-pyrimethamine remains effective as a preventive medicine.

16. Parasite resistance has rendered previously used antimalarial medicines ineffective in most parts of the world, threatening malaria control. The highly effective artemisinin derivatives and their partner drugs are vulnerable to the same risk. WHO recommends that oral artemisinin-based monotherapies be withdrawn from the market and replaced with artemisinin combination therapies.

III. Financing of malaria control

17. Advocacy efforts at the global, regional and national levels over the course of the past 10 years spurred an upsurge in terms of political and financial commitments to malaria control efforts.

18. Financial commitments to malaria control on the part of external agencies increased fivefold from approximately $0.3 billion per year in 2003 to $1.6 billion in 2009, with a particularly large increase in 2009. While commitments are critical, it is the international disbursements for malaria to malaria-endemic countries that determine progress. Such disbursements increased from $35 million in 2000 to more than $1 billion in 2008 and are estimated to have risen to $1.5 billion in 2009, a forty-fold increase.

19. The Global Fund to Fight AIDS, Tuberculosis and Malaria accounted for 66 per cent of all external funds disbursed to malaria-endemic countries between 2000 and 2007, or $2.6 billion. The United States Agency for International Development, including the President's Malaria Initiative, was second to the Global Fund as a source of funds from 2000 to 2007, increasing its malaria funding by a factor of 19, from $10 million in 2000 to $188 million in 2007. The United Kingdom Department for International Development ranked third, increasing its contributions from $2 million in 2000 to $19 million in 2007.

20. Between 2000 and 2007, the Global Fund was the dominant source of external finance in all regions except South-East Asia, where World Bank funding accounted for 55 per cent of disbursements by external agencies. In the European Region, the Global Fund accounted for 96 per cent of disbursements by external agencies between 2000 and 2007; in the Eastern Mediterranean Region, it accounted for 94 per cent, and in the Region of the Americas, it accounted for 90 per cent. In the African Region, Global Fund support accounted for 76 per cent of external support,

compared with 12 per cent for the Department for International Development, 3 per cent for the United States Agency for International Development, 2 per cent for the World Bank and 1 per cent for Japan.

21. Between 2000 and 2007, disbursements by external agencies for malaria increased by a factor of 28 in the WHO African Region, a factor of 27 in the Eastern Mediterranean Region (since 2003), a factor of 18 in the European Region, a factor of 13 in the Western Pacific Region and a factor of 8 in the Region of the Americas. Only the South-East Asia Region failed to register a substantial increase in external assistance, with the 2007 level only 1.4 times the amount seen in 2000.

22. The number of countries receiving external assistance for malaria increased from 29 in 2000 to 76 (out of a total of 109 malaria-endemic countries) in 2007, with the largest increase seen in Africa. Only two malaria-endemic sub-Saharan African countries did not receive external assistance: Botswana and Chad.

23. In general, less populous countries (for example, Suriname, Sao Tome and Principe, and Eritrea) received more funds per capita than more populous countries (such as Pakistan, China and India). Part of the reason for the apparently low levels of disbursement to the more populous countries could be that populations at risk are estimated imprecisely and are subject to overestimation. Therefore, while the observation that more populous countries received lower levels of external financing is of concern, the imprecision in defining at-risk populations in such countries should be taken into account, as should other factors that determine the need for external financing, such as the availability of domestic funds.

24. Information on domestic financing for malaria is less complete. Such financing appears to have increased in a range of countries across all regions, but there seems to have been a downward trend from 2007 to 2008 in two regions — the African and Eastern Mediterranean regions — and a steady decline between 2005 and 2008 in the South-East Asia Region. Improvements in the information available with regard to domestic financing for malaria would allow for a more accurate and complete picture of global malaria financing.

25. Government financing frequently covers the fixed costs of operating malaria programmes, including costs related to human resources and programme management (inter alia, information systems, planning workshops and supervision). The expenditures of external agencies such as the Global Fund and the President's Malaria Initiative are more often directed to the financing of variable costs, such as those for the provision and distribution of commodities.

26. While the total amount of funds available for malaria control has increased to an unprecedented level, it is still lower than the annual amount that, according to the Global Malaria Action Plan, would be needed to successfully control malaria globally: between $5.0 billion and $6.2 billion per year between 2009 and 2015. Even if the high level of malaria commitments for 2009 ($1.5 billion) is translated into disbursements and programme expenditures, and is complemented by equal levels of Government and private-sector funding,[1] the total amount of funds available for malaria control would be approximately $3 billion, or less than 60 per cent of the projected requirements.

[1] The Global Malaria Action Plan estimated Government and household financing to be approximately equal to external financing in 2007.

IV. Programme implementation: vector control

27. In 2008, 23 countries in the African Region and 35 outside it had adopted the WHO recommendation that bed nets be provided for all age groups at risk for malaria, not only for women and children. This represented an increase of 13 countries since 2007.

28. According to data provided by the Alliance for Malaria Prevention of the Roll Back Malaria Partnership, the number of long-lasting insecticide-treated nets delivered to sub-Saharan African countries rose from 5.6 million in 2004 to 88.5 million in 2009. The number of insecticide-treated nets would be sufficient to cover approximately 55 per cent of the population at risk for malaria in sub-Saharan Africa in 2009, assuming two people can sleep under a net and that nets have a lifespan of three years.

29. A further 70 million insecticide-treated nets were delivered in the first half of 2010. Some large countries with lower levels of funding are now beginning to make substantial progress. Nigeria had delivered 25 million nets by mid-2010 and is on track to deliver 64 million by early in 2011, which will make its programme the single largest scale-up effort to reach the target of universal coverage by the end of 2010.

30. Countries with higher levels of external assistance per capita (for example, Sao Tome and Principe and Djibouti) were able to procure more nets per person and to achieve higher coverage than others with lower funding ratios (including Côte d'Ivoire and Cameroon).

31. On the basis of data from household surveys and information on net procurement, it is estimated that an increased percentage of African households (31 per cent) owned at least one insecticide-treated net in 2008 as compared with 2006 (17 per cent) and that more children under 5 years of age used a net in 2008 (24 per cent) than in previous years. These weighted averages are affected by low net ownership levels in several large African countries, for which scale-up resources are only now being made available; household net ownership has reached more than 50 per cent in 13 high-burden African countries.

32. While some countries have achieved remarkable equity in terms of ownership of insecticide-treated nets among rural and urban households as well as the poorest and richest households, many countries have not done so. Equity in coverage is due largely to widespread, free net distribution campaigns targeting areas of intense malaria transmission.

33. In 2008, 44 countries, including 19 in the African Region, reported having implemented indoor residual spraying. In the African Region, the number of persons protected by spraying more than doubled between 2006 and 2008, from 15 million to 59 million. This represented 9 per cent of the at-risk population. Seven countries protected more than 10 per cent of their at-risk populations in 2008: Botswana (38 per cent), Equatorial Guinea (56 per cent), Ethiopia (51 per cent), Madagascar (32 per cent), Mozambique (30 per cent), Namibia (16 per cent) and Zambia (47 per cent).

34. In regions other than Africa, the coverage of interventions is more difficult to estimate. Interventions such as indoor residual spraying and insecticide-treated nets are often implemented in a focalized way, targeting hard-to-reach or mobile populations that are most at risk (such as migrants, miners and forest workers)

rather than general populations. Household surveys are less useful in such contexts and are conducted less frequently.

35. Analysis suggests that the number of insecticide-treated nets distributed to populations at risk was relatively high (sufficient to cover more than 20 per cent of the population, assuming nets are used by two people and have a lifespan of three years) in Suriname (58 per cent), Malaysia (54 per cent), the Sudan (55 per cent), Vanuatu (41 per cent), the Lao People's Democratic Republic (37 per cent), Bangladesh (31 per cent), Papua New Guinea (30 per cent), Solomon Islands (25 per cent), Bhutan (23 per cent), Cambodia (23 per cent), China (23 per cent) and Tajikistan (19 per cent). The coverage of the high-risk population with indoor residual spraying was more than 50 per cent in Tajikistan, Bhutan and Malaysia. The Sudan, Pakistan, Solomon Islands, the Philippines and India had spraying coverage of between 20 and 40 per cent.

36. Household surveys indicate that ownership of insecticide-treated nets was low (less than 20 per cent of households) in Djibouti, Somalia and the Sudan. They suggest that 80 per cent of children under 5 sleep under a mosquito net in Cambodia, the Lao People's Democratic Republic and Viet Nam, but that many fewer in those countries sleep under an insecticide-treated net (4 per cent, 41 per cent and 13 per cent, respectively). The percentage of children under 5 sleeping under an insecticide-treated net was 17 per cent in Papua New Guinea in 2006 and 41 per cent in Solomon Islands in 2007.

V. Programme implementation: diagnosis

37. In 2008, 20 of 45 malaria-endemic countries in the WHO African Region and 51 of 64 countries outside it reported having a policy of the parasitologic testing of suspected malaria cases among persons of all ages.

38. Of suspected malaria cases attending public health facilities in 35 high-burden countries in the African Region in 2008, 22 per cent received a test, reflecting a twofold increase since 2006. Ten countries tested more than 50 per cent of reported suspected cases in 2008.

39. The number of rapid diagnostic tests delivered increased rapidly in 2007 and 2008 from close to zero in 2005. However, the total number of tests distributed in 2008 covered only 13 per cent of the total number of suspected malaria cases reported, indicating a continuing gap in malaria diagnostic capacity.

40. A wide range of rapid diagnostic test brands are available on the market, and products differ in their performance. In addition, test performance is affected by extremes of heat and humidity, conditions that frequently prevail in the field. In order to ensure the procurement of high-quality rapid diagnostic tests, countries are advised to procure products that have demonstrated good performance in the WHO Rapid Diagnostic Test Evaluation Programme. The Programme, launched in 2006 in collaboration with the Foundation for Innovative New Diagnostics and the United States Centers for Disease Control and Prevention, assesses and reports on the performance of rapid diagnostic test products and serves as a guide for countries and procurement agencies in selecting high-quality tests. The results of two rounds of performance testing are now available. Performance testing is also aimed at helping manufacturers to improve the quality of their products. In addition, since the

performance of various production lots of individual products is likely to vary over time, it is recommended that all lots of procured products be checked for quality through lot testing prior to large-scale deployment in the field and that a process for the monitoring of rapid diagnostic test performance in the field be put in place. The Rapid Diagnostic Test Evaluation Programme provides the service of lot testing in one of three regional centres for the assessment of procured rapid diagnostic tests.

VI. Programme implementation: treatment

41. By 2009, 78 of the 83 *Plasmodium falciparum* malaria-endemic countries and territories had adopted artemisinin combination therapies for use as part of their national drug policies.

42. The continued use of oral artemisinin-based monotherapy medicines is a major factor contributing to the development of parasite resistance. Despite the appeal made by WHO for a halt in the use of these medicines (World Health Assembly resolution 60.18, endorsed by all WHO member States in May 2007), their production continues, and many countries have not yet withdrawn them from their markets. Since 2005, WHO has identified 76 pharmaceutical companies involved in the production and marketing of oral artemisinin-based monotherapy medicines. By July 2010, only 36 — mainly companies that had a significant market share in public-sector procurement funded by international agencies — had ceased their production. However, smaller companies targeting private-sector markets are more likely to ignore the WHO appeal.

43. Major reasons for the limited success in the phasing-out of oral artemisinin-based monotherapies include the poor regulation of pharmaceutical markets in malaria-endemic countries. As of July 2010, of the 78 national regulatory authorities of *Plasmodium falciparum*-endemic countries, 28 had not taken regulatory steps to withdraw such therapies from their markets. Most of those countries are located in the WHO African Region (16 national regulatory authorities), followed by the South-East Asia Region (5) and the Western Pacific Region (3). Greater assistance to national drug regulatory authorities is required in order to phase out oral artemisinin-based medicines.

44. The procurement of artemisinin combination therapies for the public sector continues to increase, rising from more than 76 million treatment courses in 2006 to more than 157 million in 2009.

45. Fourteen of the 35 high-burden countries in Africa reported distributing enough artemisinin combination therapies to treat at least 50 per cent of reported malaria cases in the public sector; five countries reported distributing a sufficient number of doses to treat all reported malaria cases in 2008. In most relevant countries outside Africa, access to first-line treatment was sufficient to cover all reported confirmed malaria cases. In all regions except South-east Asia, more than two treatment courses per confirmed case were provided.

46. The percentage of children with fever receiving an antimalarial medicine ranged from 10 per cent (Ethiopia, 2007) to 63 per cent (Gambia, 2006), with a weighted average of 32 per cent, according to household survey data from the period 2006-2008. The percentage of children with fever who received an artemisinin combination therapy ranged from zero (several countries, 2006) to

22 per cent (mainland United Republic of Tanzania, 2008), with an average of 16 per cent. Slightly higher rates of artemisinin combination therapy use were seen in 2008 than in 2006. This probably reflects increased distribution of artemisinin combination therapies but it may also be due in part to the fact that different countries were represented in the data collected by the household surveys during those two years.

47. The low uptake of artemisinin combination therapies in the treatment of febrile children may be due to a lack of availability at health facilities, high prices in the private sector and limited access to care (for example, a limited number of community care programmes). In some cases, it may also be due to improved access to parasitologic confirmation of malaria, so that only confirmed cases are provided with treatment.

48. A financing mechanism, the Affordable Medicine Facility for Malaria, is being piloted to increase access to artemisinin combination therapies and to displace cheaper but ineffective medicines and monotherapies that promote drug resistance. Managed by the Global Fund, the programme is being piloted in eight countries.

49. The first documented evidence of *Plasmodium falciparum* resistance to artemisinin in western Cambodia was published in 2008. A project aimed at curbing the spread of artemisinin-resistant strains was begun on the Thailand-Cambodia border in January 2009. Coordinated by WHO, with support from the Bill & Melinda Gates Foundation, the Global Fund and the United States Agency for International Development, the project is an intensive effort that includes interventions to detect and treat all cases in target areas, and to increase bednet coverage of the population at risk. Early in 2010, the results of the population screening programme in 20 high-risk villages indicated that the artemisinin-resistant strain of *Plasmodium falciparum* malaria had almost disappeared. Data from the first seven villages in which the programme was implemented showed that only two cases had been detected among the 2,800 persons screened. Cambodia national surveillance data have also confirmed that the number of cases of *Plasmodium falciparum* malaria in the target areas has fallen dramatically.

VII. Preventive treatment

50. Thirty-five countries in the African Region and three in the Eastern Mediterranean Region have adopted and are implementing intermittent preventive treatment of malaria for pregnant women. Papua New Guinea has also adopted a policy aimed at intermittent preventive therapy. Data on such therapy for pregnant women, collected in surveys during the period 2007-2008, were available for nine countries with a total population of 217 million. In 2007-2008, the percentage of women who received two doses of treatment during pregnancy ranged from 3 per cent in Angola to 66 per cent in Zambia; the weighted average was 20 per cent.

VIII. Impact of control programmes in the WHO African Region

51. Among high-burden African countries that achieved high coverage of their populations with bednets and treatment programmes, reductions of more than 50 per cent in the number of reported malaria cases and deaths were observed in four

countries (Eritrea, Rwanda, Sao Tome and Principe and Zambia) and one area (Zanzibar, United Republic of Tanzania). In Sao Tome and Principe and Zanzibar, reductions in the number of malaria cases and deaths were observed after two to three years of the widespread use of indoor residual spraying, long-lasting insecticide-treated nets and artemisinin combination therapies. In Rwanda, a reduction was observed only after the use of long-lasting insecticide-treated nets and artemisinin combination therapies.

52. The numbers of inpatient deaths resulting from all causes decreased by 53 per cent in Sao Tome and Principe and by 57 per cent on the islands of Zanzibar, United Republic of Tanzania, after intensive malaria control efforts. In Zambia, the all-cause child mortality rates fell by 35 per cent, as measured both by the number of deaths recorded in health facilities and by the under-5 mortality rate determined through the 2007 Demographic and Health Survey. Those trends, if confirmed in non-island countries, suggest that intensive malaria control could help many African countries to reach a two-thirds reduction in child mortality by 2015, in accordance with Millennium Development Goal 4.

53. Similar impacts may have been felt in other high-burden African countries, but changes in morbidity and mortality have not become evident, largely because disease surveillance systems are not developed sufficiently to detect changes. On the basis of the number of insecticide-treated nets distributed to 35 African countries, it is estimated that more than 560,000 lives were saved between 2000 and 2009, with most of that number saved since 2006.

54. Five of the six low-transmission African countries (Botswana, Cape Verde, Namibia, South Africa and Swaziland) saw decreases of more than 50 per cent in the number of confirmed malaria cases and reported malaria deaths between 2000 and 2008. The decrease in cases appears to have levelled off, remaining at between 10 and 25 per cent of the numbers seen in 2000. Each of these countries shows evidence of wide-scale malaria programme activity, but a drought affecting Namibia, South Africa, Swaziland and Zimbabwe between 2001 and 2003 may also have contributed to initial decreases. It is not possible to determine whether the number of cases is increasing, stable or decreasing in the other low-transmission country, Zimbabwe, but preventive activities appeared to cover more than 50 per cent of the high-risk population in 2008.

IX. Impact of control programmes in other WHO regions

55. The number of cases reported in the Region of the Americas decreased from 1.14 million in 2000 to 557,000 in 2008. Reductions of more than 50 per cent were reported in 11 countries (Argentina, Bolivia (Plurinational State of), Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Paraguay and Suriname). Four of those countries (Argentina, El Salvador, Mexico and Paraguay) were in the elimination or pre-elimination phase, with active follow-up of suspected cases, while four others (Guyana, Guatemala, Nicaragua and Suriname) showed evidence of control activities being implemented extensively for populations at risk of malaria. Three of those countries (Guyana, Nicaragua and Suriname) also had high annual blood examination rates, which indicate good access to malaria treatment. Five countries (Brazil, Colombia, Costa Rica, Panama and Peru) reported fluctuations in the number of cases between 2000 and 2008, which may be

associated with reductions in recent years. Brazil had greatly expanded the availability of diagnosis and treatment through a network of more than 40,000 health workers who reached individual households. The number of confirmed cases in French Guiana showed little change between 2000 and 2008. Three countries (the Dominican Republic, Haiti and Venezuela (Bolivarian Republic of)) reported increased numbers of cases between 2000 and 2008, although the increase in Haiti was associated with an increased annual blood examination rate. No information was provided by Belize. In summary, eight countries (Argentina, El Salvador, Guatemala, Guyana, Mexico, Nicaragua, Paraguay and Suriname) showed a decrease in the number of cases of more than 50 per cent, which is associated with intense malaria programme activity.

56. Reductions of more than 50 per cent in the number of reported cases between 2000 and 2008 were seen in five countries in the South-East Asia Region (Bhutan, the Democratic People's Republic of Korea, Nepal, Sri Lanka and Thailand). Reductions of more than 25 per cent but less than 50 per cent were seen in one country (India). There was evidence of the wide-scale implementation of antimalarial interventions in two countries that showed decreases in the number of cases (Bhutan and Thailand), although the decrease in Thailand levelled off in 2006 as the number of persons potentially reached by malaria prevention programmes decreased. Two countries at the pre-elimination stage (the Democratic People's Republic of Korea and Sri Lanka) actively followed-up on all suspected cases. The scale of preventive interventions appeared to be small in India and Nepal, with less than 50 per cent of the high-risk populations covered. The other malaria-endemic countries (Bangladesh, Indonesia, Myanmar and Timor-Leste) reported no change or an increase in the number of cases, and the scale of control activities appeared to be small in relation to the total populations at risk. In summary, four countries (Bhutan, the Democratic People's Republic of Korea, Sri Lanka and Thailand) showed a decrease in malaria cases associated with malaria programme activity, although the decrease in Thailand appears to have levelled off between 2006 and 2008.

57. The number of reported malaria cases in the European Region has been reduced substantially, from 32,474 in 2000 to 285 in 2009. Intensive control activities are implemented throughout the Region. Indoor residual spraying is the primary means of vector control, supplemented by the use of the larvivorous Gambusia fish in rice-growing areas, passive and active case detection and inter-country collaboration in affected border areas; in 2005, all nine malaria-affected countries in the European Region endorsed the Tashkent Declaration, whose goals are to interrupt malaria transmission by 2015 and to eliminate the disease within the Region. The last two cases of locally acquired *Plasmodium falciparum* malaria were reported in Tajikistan in 2008. If no further cases are reported in the Region, 2009 will have marked the year in which this type of malaria was eliminated there. In summary, all malaria-endemic countries in the European Region have active malaria control programmes and have reported sustained decreases of more than 50 per cent in the number of cases.

58. Four countries in the Eastern Mediterranean Region (Afghanistan, Iran (Islamic Republic of), Iraq and Saudi Arabia) reported downward trends in malaria frequency. There was evidence of intense control activities in Iran (Islamic Republic of), Iraq and Saudi Arabia, which were classified as in the elimination or pre-elimination phase. Other countries in the Region (Djibouti, Pakistan, Somalia, the Sudan and Yemen) had not registered consistent decreases in the number of cases,

although the Sudan had expanded the coverage of its malaria preventive activities to more than 50 per cent of the at-risk population. In summary, three countries (Iran (Islamic Republic of), Iraq and Saudi Arabia) showed evidence of a sustained decrease in the number of cases associated with the wide-scale implementation of malaria control activities.

59. Three countries (the Lao People's Democratic Republic, the Republic of Korea and Viet Nam) reported decreases of more than 50 per cent in the number of confirmed cases between 2000 and 2008, and three countries (Malaysia, Solomon Islands and Vanuatu) reported decreases of more than 25 per cent during the same period. In all six of those countries, there was evidence of the wide-scale implementation of malaria control activities. No evidence of a sustained decrease in the number of cases was found in Cambodia, China, Papua New Guinea or the Philippines. Evidence of increased preventive or curative activities was seen in all these countries, in particular the Philippines, but either such activities had been too recent for their effects to be apparent or weaknesses in surveillance systems had prevented changes from being detected. In summary, six countries (the Lao People's Democratic Republic, Malaysia, the Republic of Korea, Solomon Islands, Vanuatu and Viet Nam) showed evidence of a sustained decrease in the number of cases associated with the wide-scale implementation of malaria control activities.

X. Elimination

60. WHO encourages countries in areas of low, unstable transmission to proceed to malaria elimination (the interruption of transmission).[2] The conditions that are prerequisites for achieving and sustaining malaria elimination in such settings include the presence of a health system providing nationwide coverage of quality-controlled services, including surveillance. In areas of high, stable transmission with unrelentingly high vectorial capacities, such as many parts of tropical Africa, achieving and sustaining a malaria-free status is improbable, given the currently available malaria control tools.

61. Ten countries (Algeria, Azerbaijan, Georgia, Iraq, Kyrgyzstan, the Republic of Korea, Saudi Arabia, Tajikistan, Turkey and Uzbekistan) are implementing elimination programmes nationwide. Of these, Saudi Arabia is the only country that still has active *Plasmodium falciparum* transmission and that is located outside the Palearctic ecozone. Four of the countries (Algeria, Iraq, Georgia and Uzbekistan) report fewer than 10 local cases annually nationwide, and a further two countries report fewer than 100 cases annually.

62. Eight countries (Argentina, the Democratic People's Republic of Korea, El Salvador, Iran (Islamic Republic of), Malaysia, Mexico, Paraguay and Sri Lanka)

[2] Malaria elimination: the interruption of local mosquito-borne malaria transmission; reduction to zero of the incidence of infection caused by human malaria parasites in a defined geographical area as a result of deliberate efforts; continued measures to prevent the re-establishment of transmission are required. Certification of malaria elimination can be granted by WHO after it has been proved beyond reasonable doubt that the chain of local human malaria transmission by Anopheles mosquitoes has been fully interrupted in an entire country for at least three consecutive years. Malaria eradication: permanent reduction to zero of the worldwide incidence of infection caused by a specific agent; applies to a particular malaria parasite species. Intervention measures are no longer needed once eradication has been achieved.

are in the pre-elimination stage and are moving towards a nationwide elimination approach.

63. A further eight countries have recently interrupted transmission. Outbreaks of new local transmission have occurred in recent years in the Bahamas, Jamaica and the Russian Federation, and have recurred in Oman after a three-year absence. Together with the Syrian Arab Republic (where the last local case was reported in 2004), Armenia, Turkmenistan (last local cases reported in 2005) and Egypt, these countries make up the group of countries that are seeking to prevent the reintroduction of transmission. To that end, strong surveillance systems are essential.

64. In May 2010, Morocco became the second country in recent history to be certified by WHO as having achieved malaria elimination; the United Arab Emirates was certified in January 2007. Morocco reported its last case of indigenous *Plasmodium vivax* malaria transmission in 2004. Turkmenistan and Armenia have initiated the process for certification of malaria elimination.

65. Eight countries in the Southern African Development Community are currently implementing a cross-border approach to the elimination of malaria in the region. The initiative, entitled "Elimination 8", involves Botswana, Namibia, South Africa, Swaziland, Angola, Mozambique, Zambia and Zimbabwe, and is supported by WHO, the Roll Back Malaria Partnership and the University of California, San Francisco.

XI. Summary and recommendations

66. Progress is being made towards achieving the goals concerning malaria control set by the World Health Assembly and the Roll Back Malaria Partnership, including halving the 2000 malaria burden by the end of 2010. Particularly encouraging is the increased availability of long-lasting insecticide-treated nets. In Africa alone, 240 million nets were distributed between 2006 and 2009. Those efforts, coupled with the targeted application of indoor residual spraying and modest increases in access to artemisinin combination therapies, have begun to produce results.

67. In countries where malaria control interventions have been scaled up, not only have the rates of malaria cases, hospitalizations and deaths dropped dramatically, but the overall child mortality rates are also in steep decline. National disease surveillance data from Eritrea, Sao Tome and Principe, Rwanda, Zambia and Zanzibar, in the United Republic of Tanzania, showed more than a 50 per cent reduction in the number of health facility malaria cases and deaths following accelerated malaria control interventions. In Sao Tome and Principe and Zanzibar, those gains were mirrored by more than a 50 per cent decline in all-cause inpatient cases and deaths among children under 5 years of age. In Zambia, the all-cause child mortality rate fell by 35 per cent, as measured both by the number of deaths recorded in health facilities and by under-5 mortality ratios determined through the 2007 Demographic and Health Survey. The magnitude of those decreases is similar to that found in a recent study conducted on Bioko island, Equatorial Guinea, in which population-based under-5 mortality decreased by 66 per cent by the fourth year after the start of intensive malaria control activities. Such evidence suggests that intensive malaria control could play an important role in helping African countries reach the Millennium Development Goal 4 target of reducing child mortality by two thirds by 2015.

68. Furthermore, a decrease of more than 50 per cent in the reported number of confirmed malaria cases was found between 2000 and 2008 in 29 of the 56 malaria-endemic countries outside Africa and in 5 of the 6 low-burden African countries. Downward trends of more than 25 per cent were seen in five other countries, most of which showed longer-term decreases of more than 50 per cent. Ten countries are implementing elimination programmes nationwide, while eight countries are in the pre-elimination phase. A further eight countries have recently interrupted transmission and are at the stage of preventing the reintroduction of malaria. In May 2010, Morocco became the second country in recent history to be certified by WHO as having achieved malaria elimination.

69. It appears that large quantities of external assistance for malaria control are having an effect. Countries receiving more than $7 in external assistance per at-risk person between 2000 and 2007 were more likely to report a reduction in the number of malaria cases since 2000 than countries receiving $6 or less. Although the number of countries with such high levels of assistance is small (only 10), this observation suggests that high levels of external assistance per person at risk for malaria are associated with decreases in the incidence of the disease.

70. While those results are encouraging, some shortfalls in terms of progress are evident. Nearby 70 per cent of households in Africa did not own an insecticide-treated net in 2008, and three quarters of children under 5 did not use one. Those results are affected by low net ownership in several large African countries, for which scale-up resources are only now being made available. Use of artemisinin combination therapies remains very low in most African countries; in 11 of the 13 countries surveyed during 2007-2008, fewer than 15 per cent of under-5 children with fever had received such a therapy, which is far below the World Health Assembly target of 80 per cent.

71. Outside Africa, the countries showing more than a 50 per cent decrease in the number of cases accounted for only 4 per cent of the estimated total number of cases outside Africa in 2006 (850,000 cases, out of an estimated 34 million). The countries with the highest malaria burdens in each region (including Bangladesh, Brazil, Cambodia, Colombia, Indonesia, Myanmar, Pakistan, Papua New Guinea and the Sudan) were less successful in reducing their numbers of malaria cases. Greater attention needs to be given to ensuring success in large countries that account for most malaria cases and deaths.

72. While efforts should be made to achieve and maintain universal coverage of all malaria control interventions, there is a particular need to ensure universal access to diagnostic tests for malaria. As transmission falls, so does the proportion of fevers attributable to malaria. By treating all cases of fever as malaria, we not only overuse artemisinin combination therapies, but also fail to provide appropriate care to people with fever caused by other diseases. Expansion of the use of rapid diagnostic tests will help to reduce the overtreatment of fever as malaria. However, malaria tests alone are not enough. In the absence of rapid tests for other common causes of fever, training and supervision to reinforce the differential diagnosis skills of health-care workers is essential. It is also essential that appropriate medicines be available at the point of care for the management of malaria and other diseases. Otherwise, there is a risk that patients with negative test results will be given antimalarial medicines.

73. There is also a need to implement routine surveillance systems that will provide timely information regarding the progress made as a result of programmes. The scale-up of universal diagnostic testing presents an unprecedented opportunity to strengthen malaria surveillance systems, which are critical not only for documenting impact, but also for identifying residual foci of malaria transmission and areas of resurgence. In countries where malaria transmission has dropped sharply, immunity to the disease will wane, resulting in a high risk of resurgence. Without the timely reporting of confirmed cases, it will not be possible to detect or respond to such resurgences promptly. The human toll of outbreaks in countries that have failed to prepare for them is likely to be great. The scaling-up of diagnostic testing and surveillance is thus particularly critical in countries that are considering a reorientation of their control programmes towards elimination.

74. Resistance to artemisinins has been found in Asia, and if containment efforts are unsuccessful, there is a high risk that it will eventually spread westward to Africa and beyond. Countries need to redouble their efforts at the global level to halt the marketing and use of oral artemisinin alone, which is thought to be the primary contributor to the emergence and spread of artemisinin resistance. High-quality combination therapies need to be available in both public and private health facilities at an affordable price. In order to ensure the prompt detection of resistance, we need to ensure the routine conduct of drug efficacy studies, in which patients with malaria are treated with recommended antimalarial medicines and monitored for up to 63 days in order to determine success or failure.

75. Poor-quality and counterfeit medicines are widespread, especially in the private sector. Such medicines not only jeopardize the lives of individual patients, who may fail to receive appropriate malaria treatment, but also have the potential to fuel antimalarial-drug resistance. The global community needs to increase support for national drug regulatory authorities so that they can build their capacity to identify counterfeit and substandard medicines and enforce existing regulations by removing such products from the market.

76. There are a number of quality issues concerning rapid diagnostic tests, and it is widely recognized that malaria microscopy services are often poor. Countries will require further help with the pre-marketing quality control of diagnostic tests (through the evaluation of both performance and manufacturing quality) and with routine lot quality testing, as well as with quality assurance and quality control as part of national control programmes.

77. Although health-care workers are essential in the fight against malaria, they cannot succeed without community engagement. Ministries of health should view communities as active participants in malaria control programmes and work to persuade them to take ownership over as many aspects of such programmes as possible, including ensuring that every person sleeps under an insecticide-impregnated mosquito net every night; providing community management of fever; and gathering data both for local action and for feeding into a national malaria surveillance system. If communities can be empowered to be on centre stage in the fight against malaria, rather than simply being seen as the end-users of commodities and services, the political will to combat malaria will not fade, even if donor funding does.

78. While the need for continued financial resources, targeted to priority countries and programmes, cannot be dismissed, one theme runs through these action areas:

the capacity of ministries of health to deliver effective malaria control must be increased. The gains from increased investment are likely to be ephemeral unless ministries remain the centre of gravity and receive the capacity-building and long-term human resource investment at all levels of the system (national, provincial, district and community) necessary to manage increasingly complex programmes. It is critical that donor contributions be well coordinated with national malaria control programmes and that funding for commodities to control malaria be tightly linked to true capacity-building, including the provision of long-term technical assistance and the extensive training of staff at all levels of the health system. At the same time, Governments of countries where malaria is endemic should be urged to provide the investments in human resources necessary to guarantee long-term success. In the end, malaria control can both contribute to and benefit from strengthened health systems.